RAIN DROP SENSOR AND RAIN-DROP-SENSITIVE WIPER
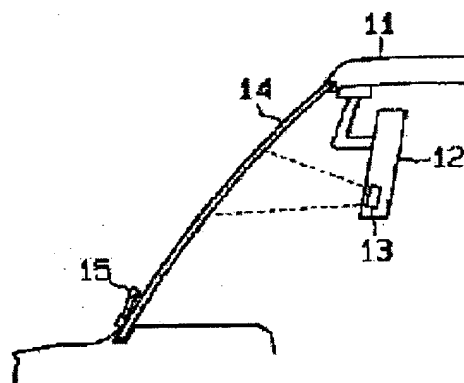
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Abstract of **JP9126998**

PROBLEM TO BE SOLVED: To provide a rain-drop-sensitive wiper using a rain drop sensor capable of detecting the difficulty in seeing through a front window.

SOLUTION: The image of a front window 14 is inputted to the rain drop sensor 13 of the rain-drop-sensitive wiper, thus directly detecting a rain drop W adhered to the front window 14. Then, the rain drop sensor 13 calculates a total S of the difference in the brightness of each picture element G according to the amount of the detected rain drops W and outputs the calculated total S as a detection signal. Then, a judgment circuit compares the inputted total S with a threshold S0 , judges that the front window 14 has become different to see through when the total S reaches the threshold S0 , and drives and controls a wiper motor based on the judgment result, thus operating a wiper 15.

* NOTICES *

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2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

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CLAIMS

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[Claim(s)]
[Claim 1] A raindrop sensor equipped with a coating weight detection means (17) to output a detecting signal (S) according to an amount of an affix (W) adhering to said transparent body (14) based on brightness of each pixel (G) of an image inputted by image input means (16) to input an image of a predetermined field on the surface of the transparent body (14), and said image input means (16).
[Claim 2] In a raindrop sensor according to claim 1 said coating weight detection means An average luminance operation means to calculate average luminance of each pixel (G) of an image inputted by said image input means (16) (17), A raindrop sensor which consisted of a brightness difference operation means (17) to calculate a difference of average luminance calculated with said average luminance operation means (17), and brightness of each pixel (G), and a total operation means (17) to calculate total of a difference of brightness of each pixel (G) calculated with said brightness difference operation means (17).
[Claim 3] A raindrop induction wiper for detecting a raindrop (W) adhering to a front window (14), and driving and wiping away a wiper (15) according to the amount of raindrops characterized by providing the following A raindrop sensor according to claim 1 or 2 which detects a raindrop (W) adhering to a predetermined field of a front window (14), and outputs a detecting signal (S) according to the amount of raindrops A decision means to judge whether said front window (14) can be easily seen based on the amount of raindrops detected by said raindrop sensor (13) (20) A wiper driving means which drives a wiper (15) based on a decision result of said decision means (20) (21 22)
[Claim 4] It is the raindrop induction wiper which judged whether a threshold (S0) beforehand determined as a detecting signal (S) according to the amount of raindrops which inputted said decision means (20) from said raindrop sensor (13) in a raindrop induction wiper according to claim 3 would be compared, and said front window (14) could be easily seen based on the comparison result.
[Claim 5] It is the raindrop induction wiper which detected a raindrop (W) which said raindrop sensor (13) was formed in an inner mirror (12) of an automobile (11) in a raindrop induction wiper according to claim 3 or 4, and adhered to the eradication range of a wiper (15).

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[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[The technical field to which invention belongs] This invention relates to a raindrop sensor and a raindrop induction wiper, is prepared in an automobile in detail, and relates to the raindrop sensor which detects the raindrop adhering to a front window, and the raindrop induction wiper which wipes away the raindrop.
[0002]
[Description of the Prior Art] Conventionally, an operator needs to switch a windshield wiper switch according to change of the amount of the run state of an automobile, and the raindrop adhering to a front window at the time of a rainfall. Therefore, there are some which are equipped with the raindrop induction wiper which wipes away the raindrop which was made to drive a wiper automatically at the time of a rainfall, and adhered to the front window in an automobile. A raindrop induction wiper detects rainfall by the raindrop sensor, it is changing automatically the gap which operates a wiper according to the rainfall, and it is prepared in order to improve the troublesomeness to which an operator switches a windshield wiper switch.
[0003] Sensors, such as a capacity sensor, a sway sensor, and a light reflex sensor, are used for the raindrop sensor. A capacity sensor and a sway sensor detect the amount of the raindrop poured on the portion in which those sensors were formed, and output the detecting signal according to the amount of raindrops. Moreover, a light reflex sensor detects the quantity of light of the reflected light from which the light which irradiated the front window changes with the adhering raindrops, and outputs the detecting signal according to the quantity of light.
[0004]
[Problem(s) to be Solved by the Invention] However, in a capacity sensor and a sway sensor, the raindrop adhesion condition of an actual front window is not detected, and the raindrop which adhered to the sensor portion by chance detects the raindrop adhesion condition of the whole front window indirectly. Moreover, by the light reflex sensor, although the raindrop adhesion condition of an actual front window is detected, since the raindrop which adhered to the location of light where the detection range was narrowly irradiated by the front window by chance detects a raindrop adhesion condition, it may be widely different with the raindrop condition of the whole front window.
[0005] It is made in order that this invention may solve the above-mentioned trouble, and the purpose is in offering the raindrop sensor which can detect the difficulty of being visible of a front window. Moreover, it is in offering the raindrop induction wiper using such a raindrop sensor.
[0006]
[Means for Solving the Problem] In order to solve the above-mentioned trouble, invention according to claim 1 makes it a summary to have had a coating weight detection means to output a detecting signal according to an amount of an affix adhering to said transparent body, based on brightness of each pixel of an image inputted by image input means to input an image of a predetermined field on the surface of the transparent body, and said image input means.

[0007] Invention according to claim 2 is set in a raindrop sensor according to claim 1. Said coating weight detection means An average luminance operation means to calculate average luminance of each pixel of an image inputted by said image input means, Let it be a summary to have constituted from a brightness difference operation means to calculate a difference of average luminance calculated with said average luminance operation means, and brightness of each pixel, and a total operation means to calculate total of a difference of brightness of each pixel calculated with said brightness difference operation means.

[0008] Invention according to claim 3 detects a raindrop adhering to a front window. A raindrop sensor according to claim 1 or 2 which is a raindrop induction wiper for driving and wiping away a wiper according to the amount of raindrops, detects a raindrop adhering to a predetermined field of a front window, and outputs a detecting signal according to the amount of raindrops, Let it be a summary to have had a decision means to judge whether said front window can be easily seen, and a wiper driving means which drives a wiper based on a decision result of said decision means based on the amount of raindrops detected by said raindrop sensor.

[0009] Let it be a summary for invention according to claim 4 to have judged whether in a raindrop induction wiper according to claim 3, said decision means would compare a threshold beforehand determined as a detecting signal according to the amount of raindrops inputted from said raindrop sensor, and said front window could be easily seen based on the comparison result.

[0010] In a raindrop induction wiper according to claim 3 or 4, said raindrop sensor is formed in an inner mirror of an automobile, and invention according to claim 5 makes it a summary to have detected a raindrop adhering to the eradication range of a wiper.

[0011] Therefore, according to invention according to claim 1, an image of a predetermined field on the surface of the transparent body is inputted by image input means, and a detecting signal according to an amount of an affix which adhered to the transparent body with a coating weight detection means is outputted based on brightness of each pixel of the image.

[0012] Moreover, according to invention according to claim 2, a coating weight detection means consists of an average luminance operation means, a brightness difference operation means, and a total operation means. With an average luminance operation means, average luminance of each pixel of an image inputted by image input means calculates. With a brightness difference operation means, a difference of average luminance calculated with an average luminance operation means and brightness of each pixel calculates. With a total operation means, total of a difference of brightness of each pixel calculated with a brightness difference operation means calculates, and the total is outputted as a detecting signal according to an amount of an affix.

[0013] Moreover, according to invention according to claim 3, a raindrop adhering to a predetermined field of a front window is detected by raindrop sensor, and a detecting signal according to the amount of raindrops is outputted. It is judged whether based on the detecting signal, a front window can be easily seen, and a raindrop which a wiper drove based on the decision result, and adhered to a front window is wiped away.

[0014] Moreover, according to invention according to claim 4, a threshold beforehand determined as a detecting signal according to the amount of raindrops inputted from a raindrop sensor is compared, and it is judged whether based on the comparison result, a front window can be easily seen.

[0015] Moreover, according to invention according to claim 5, a raindrop sensor is formed in an inner mirror of an automobile, and a raindrop adhering to the eradication range of a wiper is detected.

[0016]
[Embodiment of the Invention] Hereafter, the gestalt of the 1 operation which materialized this invention is explained according to drawing 1 - drawing 4 . As shown in drawing 1 , the raindrop sensor 13 as an image input means is formed in the inner mirror 12 of an automobile 11. The raindrop sensor 13 detects affixes, such as a raindrop adhering to the front window 14, and the affix is used in order to operate a wiper 15 and to wipe away. The raindrop sensor 13 inputs the image of the predetermined field of the front window 14. And the raindrop sensor 13 detects the raindrop as an affix adhering to the front window 14 based on the inputted image, and outputs the detecting signal corresponding to the amount of

raindrops.

[0017] As shown in drawing 3 , the raindrop sensor 13 consists of CCD camera 16 and a pixel brightness arithmetic circuit 17. As shown in drawing 2 , CCD camera 16 is equipped with a lens 18 and CCD19. The depth of focus is shallow (for example, about 1m), and the lens 18 is set up. Therefore, on CCD19, image formation of the image near the outside of the front window 14 and the image of Raindrop W which adhered to the front window 14 in more detail is carried out. On the other hand, on CCD19, the quantity of light by which image formation of the scene around an automobile 11 etc. is not carried out on CCD19, but incidence is carried out to CCD19 serves as homogeneity mostly.

[0018] CCD19 -- for example, 100x -- it is two-dimensional CCD of 100= 10,000-pixel monochrome. And the image of the predetermined field (for example, 50mmx50mm) of the front window 14 is inputted into CCD19 with a lens 18. This area size is set up sufficiently greatly compared with the conventional magnitude or the conventional field to detect of a raindrop sensor. Moreover, the field is set as eradication within the limits the front window 14 is wiped away by whose wiper 15. And CCD19 outputs the signal (brightness) of each pixel of the inputted image to the pixel brightness arithmetic circuit 17.

[0019] The pixel brightness arithmetic circuit 17 calculates the total S of the difference of the average x, and the average x and the brightness of each pixel of the brightness of each pixel inputted from CCD camera 16. And the pixel brightness arithmetic circuit 17 is outputted to the judgment circuit 20 by making calculated total S into a detecting signal.

[0020] Drawing 4 (a) shows the pixel G of the image of the front window 14 to which Raindrop W etc. has not adhered, and drawing 4 (b) shows the pixel G of the image of the front window 14 to which Raindrop W etc. adhered. In addition, both drawing 4 (a) and drawing 4 (b) show the 5x5=25 piece pixel G, in order to prevent a drawing becoming complicated.

[0021] When Raindrop W etc. has not adhered to the front window 14, as shown in drawing 4 (a), since the depth of focus of a lens 18 is shallow, image formation of the scene which is distant from the front window 14 is not carried out on CCD19, and the whole serves as brightness of homogeneity mostly. Since the average x of the brightness of each pixel G is in agreement with the brightness of each pixel G at this time, it becomes the total S= 0 of the difference of the average x and the brightness of each pixel G.

[0022] When Raindrop W etc. adheres to the front window 14, as shown in drawing 4 (b), image formation is locally carried out to Pixel G by the affix. And a difference arises in the brightness of the pixel G to which Raindrop W has not adhered, and the brightness of the pixel G to which Raindrop W adhered. At this time, the pixel brightness arithmetic circuit 17 calculates the average x of the brightness of each pixel G first. Next, the pixel brightness arithmetic circuit 17 searches for the difference of this average x and the brightness of each pixel G, and calculates the total S of the difference of each pixel G. This total S is the variation of the brightness of each pixel G, and Total S becomes large, so that there are many amounts of the raindrop W adhering to the front window 14.

[0023] That is, the calculated total S supports the amount of raindrops adhering to the front window 14. And the brightness of each pixel G of the image of the front window 14 is not so uniform as this total S is large, namely, there are many raindrops W adhering to the front window 14, and an operator's front cannot be easily seen.

[0024] Therefore, direct detection of the raindrop W which the raindrop sensor 13 inputted the image of the front window 14, and adhered to the front window 14 is carried out, and the total S of the difference of the brightness of each pixel G according to the amount of the detected raindrop W is calculated. And the raindrop sensor 13 outputs the calculated total S as a detecting signal. Moreover, since the field which the raindrop sensor 13 detects is large enough compared with the field which the conventional raindrop sensor detects, the condition of the raindrop W adhering to the field is close to the raindrop adhesion condition of the front window 14 whole.

[0025] In addition, the average x of the brightness of each pixel G is calculated for influencing and carrying out effect of change of outer brightness. That is, the brightness of the image inputted into each pixel G is bright in a location with the lighting of day ranges, a streetlight, etc., and brightness is dark in

a place without lighting. Therefore, when change of the brightness of each pixel G adheres [Raindrop W etc.] compared with change of the brightness of day ranges and Nighttime, the change of brightness is smaller, and it is hard to detect. Therefore, change of brightness is made easy to detect, when the average x of the brightness of each pixel G is calculated, change of the brightness of the front window 14 whole is canceled by calculating the difference of the average x and brightness of each pixel G and Raindrop W etc. adheres.

[0026] The judgment circuit 20 inputs the total S as a detecting signal from the pixel brightness arithmetic circuit 17. Moreover, the judgment circuit 20 is the threshold S0 set up beforehand. It inputs. And the judgment circuit 20 is Total S and a threshold S0. It compares and judges whether the front window 14 can be easily seen based on the comparison result.

[0027] Threshold S0 A value in case an operator judges the front to be hard to see and operates a wiper 15 by affixes, such as the raindrop W adhering to the front window 14, is beforehand calculated by experiment, and is set up. Therefore, Total S is a threshold S0. When small, an operator can see the front, and Total S is a threshold S0. When it is above, as for an operator, the front becomes hard to see. Therefore, Total S is a threshold S0. When it reaches, the front can become easy to be seen [an operator] by wiping away the raindrop W which was made to drive a wiper 15 and adhered to the front window 14.

[0028] That is, the total S which inputted the judgment circuit 20 as a detecting signal is a threshold S0. When small, it judges that the front window 14 can tend to be seen, and Total S judges that the front window 14 cannot be easily seen, when larger than a threshold S0. And if Total S has many amounts of the raindrop W adhering to the front window 14, it will become large, and if there are few amounts of Raindrop W, it will become small. Therefore, the judgment circuit 20 is Total S and a threshold S0. By comparing, the amount of the raindrop W adhering to the front window 14 and the amount set up beforehand are measured, and it judges whether there to be or many amounts of Raindrop W are few. And the judgment circuit 20 outputs the signal according to the decision result to the drive circuit 21.

[0029] The windshield wiper motor 22 for operating a wiper 15 is connected to the drive circuit 21. Moreover, the manual switch 23 and the auto switch 24 are connected to the drive circuit 21. The manual switch 23 is a common wiper control switch, and although only one circuit is illustrated, when operated by ON, it is for performing the intermittent control action of predetermined time, low-speed actuation, high-speed operation, etc. If the manual switch 23 is operated by ON, the drive circuit 21 will carry out drive control of the windshield wiper motor 22, will operate a wiper 15, and will wipe away the front window 14.

[0030] The auto switch 24 is formed in the above mentioned wiper control switch. If the auto switch 24 is operated by ON, the drive circuit 21 will carry out drive control of the windshield wiper motor 22 based on the signal inputted from the judgment circuit 20, will operate a wiper 15, and will wipe away the front window 14. The signal inputted into the drive circuit 21 from the judgment circuit 20 supports the amount of the raindrop W adhering to the difficulty 14 of being visible of the front window 14, i.e., a front window. Therefore, it makes it easy to be for the drive circuit 21 to carry out drive control of the windshield wiper motor 22, to operate a wiper 15, to wipe away the front window 14, and visible in the front window 14, when the front window 14 stops being able to be visible easily.

[0031] A raindrop induction wiper is constituted by the above-mentioned raindrop sensor 13, the judgment circuit 20, the drive circuit 21, a windshield wiper motor 22, and the wiper 15, and affixes, such as the raindrop W adhering to the front window 14, are wiped away.

[0032] In addition, the total S calculated by the pixel brightness arithmetic circuit 17 changes according to the amount of the raindrop W adhering to the front window 14. Therefore, when there is much rainfall, Total S is compared when there is little rainfall, and it is a threshold S0 at short time amount. It reaches. Therefore, when there is much rainfall, compared with the case where there is little rainfall, an intermittent drive is carried out at a short gap, and a wiper 15 wipes away the raindrop adhering to the front window 14. And if a raindrop is wiped away, since the difference of the brightness of each pixel G detected by the raindrop sensor 13 will be lost, it becomes total S= 0 and is reset.

[0033] According to the gestalt of this operation, the following effects are done so as described above.

(1) The raindrop sensor 13 carries out direct detection of the raindrop W which inputted the image of the front window 14 and adhered to the front window 14. And the raindrop sensor 13 calculates the total S of the difference of the brightness of each pixel G according to the amount of the detected raindrop W, and it was made to output the calculated total S as a detecting signal. Consequently, the raindrop W which actually adhered to the front window 14 can be detected, and the difficulty of being visible can be detected based on the amount of raindrops.

[0034] (2) A raindrop induction wiper is based on the difference of the brightness of each pixel G by the raindrop W adhering to the front window 14 which carried out direct detection by the raindrop sensor 13, and the total S of the difference of the brightness is a threshold S0. When it reached, it was made to operate a wiper 15. Consequently, when there is much rainfall, a wiper 15 can be made to drive a wiper 15 according to drive ****** of raindrops, i.e., the amount, compared with the case of being few, at a short gap. Therefore, there is no troublesomeness which carries out switch actuation of the actuation of a wiper 15, and it can operate comfortably.

[0035] In addition, this invention may be changed as follows and the same operation and the same effect are acquired also in such a case.

(1) Although the raindrop which formed the raindrop sensor 13 in the inner mirror 12, and adhered to the front window 14 was detected with the gestalt of the above-mentioned implementation, the location in which the raindrop sensor 13 is formed may be changed suitably, and may be carried out. In that case, if the location of the raindrop sensor 13 is a location which can detect eradication within the limits of a wiper 15, it is good anywhere, for example, as shown in drawing 5 , it may be established in an instrument panel 31.

[0036] (2) The total S by the amount of raindrops detected with the gestalt of the above-mentioned implementation is a threshold S0. Although the raindrop W which drive control of the windshield wiper motor 22 was carried out, and the wiper 15 was operated, and adhered was wiped away when it reached, you may make it change the gap which carries out the intermittent drive of the windshield wiper motor 22 according to the detected amount of raindrops.

[0037] (3) Although shape was taken with the gestalt of the above-mentioned implementation to the raindrop induction wiper 15 to which the raindrop W adhering to the front window 14 is detected, and the intermittent control action of the wiper 15 is carried out according to the amount of raindrops, the wiper of a rear window may be materialized and carried out to the raindrop induction wiper which carries out an intermittent control action.

[0038] (4) With the gestalt of the above-mentioned implementation, although CCD19 was used as an image input means, you may carry out using a photo transistor array, a photodiode array, etc.

(5) In the gestalt of the above-mentioned implementation, the number of pixels of CCD19 may be changed suitably, and may be carried out. Moreover, the area size to detect may be changed suitably and may be carried out.

[0039] As mentioned above, although the gestalt of each implementation of this invention was explained, technical thought other than the claim which can be grasped from the gestalt of each operation is indicated with those effects below.

(b) Said affix is affix detection equipment according to claim 1 or 2 which is Raindrop W. According to this configuration, it becomes detectable easily about the amount of the raindrop adhering to the predetermined field of the transparent body.

[0040] (b) Said raindrop sensor 13 is the raindrop induction wiper according to claim 3 or 4 which detected the raindrop W which was prepared in the instrument panel 31 of an automobile 11, and adhered to the eradication range of a wiper 15. According to this configuration, it becomes possible to detect the raindrop W which adhered to the eradication range of a wiper 15 easily.

[0041]

[Effect of the Invention] As explained in full detail above, according to this invention, the raindrop sensor which can detect the difficulty of being visible of a front window can be offered. Moreover, the raindrop induction wiper using such a raindrop sensor can be offered.

[Translation done.]

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] The outline side elevation of the automobile equipped with the raindrop sensor of the gestalt of 1 operation.
[Drawing 2] The schematic diagram of a CCD camera.
[Drawing 3] The electric block diagram of a raindrop induction wiper.
[Drawing 4] (a) The schematic diagram and (b) which show the pixel which ******(ed) Schematic diagram showing the pixel which inputted the adhering raindrop.
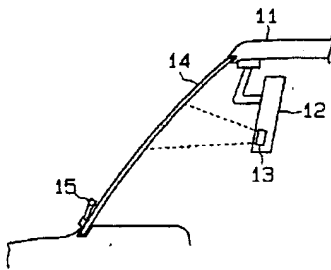[Drawing 5] The outline side elevation of the automobile of the gestalt of another operation.
[Description of Notations]
11 [-- The front window as the transparent body,] -- An automobile, 12 -- An inner mirror, 13 -- A raindrop sensor, 14 15 -- A wiper, 16 -- The CCD camera as an image input means, 17 -- The pixel brightness arithmetic circuit as a coating weight detection means, an average luminance operation means, a brightness difference operation means, and a total operation means, 20 [-- The total as a detecting signal, and S0 / -- / -- Raindrop as an affix. / A threshold, G -- A pixel, W] -- The judgment circuit as a decision means, 21 -- The drive circuit as a wiper driving means, 22 -- The windshield wiper motor as a wiper driving means, S
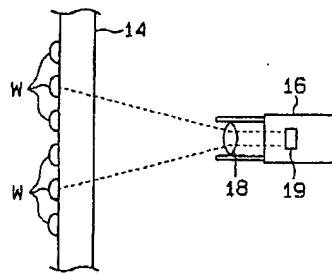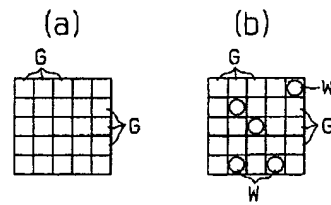

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【図1】

【図2】

【図4】

(a)　(b)

【図5】

【図3】